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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/826,961	04/15/2004	Mangu Kang	51876P609	2268

8791 7590 08/09/2005

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EXAMINER

DIAMOND, ALAN D

ART UNIT PAPER NUMBER

1753

DATE MAILED: 08/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/826,961

Applicant(s)

KANG ET AL.

Examiner

Alan Diamond

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-4 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>04152004</u> . | 6) <input type="checkbox"/> Other: ____.  |

## **DETAILED ACTION**

### ***Specification***

1. The disclosure is objected to because of the following informalities: On page 5, at line 6, the term "iodide (I<sub>2</sub>)" should be changed to "iodine (I<sub>2</sub>)". On page 5 at each of lines 18 and 20, on page 6 at line 3, on page 7 at each of lines 5 and 13, and on page 9 at line 13, the term "transitive" should be changed to "transition". Appropriate correction is required.

### ***Claim Objections***

2. Claim 1 is rejected to because of the following informalities: In claim 1, at line 5, the word "being" should be deleted. Appropriate correction is required.

### ***Suggested Claim Language***

3. In claim 1, at lines 3 and 6, the term "confronting" should be changed to "counter".

### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, at line 4, it is not clear what is to be encompassed by the term "1,3-vinylalkylimiazolium iodide family". It is not clear how close the electrolyte must be to 1,3-vinylalkylimidazolium to be considered to be of the "1,3-vinylalkylimiazolium iodide

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family". It is suggested that "family" be deleted from said term. The same applies to dependent claims 2-4.

Claim 2 is indefinite because it is not clear what is meant by the term "(I<sup>2</sup>)". It is suggested that said term be changed to "(I<sub>2</sub>)".

In claim 3 at each of lines 4 and 5, and in claim 4 at line 2, it is not clear what is meant by the term "transitive". It is suggested that said term be changed to "transition" in each of claims 3 and 4.

Claim 3 is definite because it is not clear how "a transitive metal oxide layer" recited at the last two lines, i.e., at lines 5-6, is related to or distinguished from the transitive metal oxide recited at line 4, or how it is related to or associated with the semiconductor electrode at line 2. There is no structural cooperative relationship of said "a transitive metal oxide layer" recited at lines 5-6 with any of the other parts of the semiconductor electrode. In view of page 5 lines 17-24, page 7 lines 7-17, and page 9 lines 13-19, of the instant specification, the term ", and a transitive metal oxide layer" at lines 5-6 of claim 3 should be deleted, and then the term "substrate," at line 3 of claim 3 should be changed to "substrate and".

### ***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Gratzel et al (U.S. Patent 5,728,487).

Gratzel et al teaches a dye sensitized solar cell comprising a semiconductor electrode; a counter electrode (i.e., instant confronting electrode); and an electrolyte between the semiconductor electrode and counter electrode, wherein the electrolyte can be 1-hexyl-3-vinylimidazolium iodide, which reads on the instant 1,3-vinylalkylimidazolium iodide (see the imidazolium chemical formula at the top of col. 3; col. 1, lines 4-13; and col. 4, lines 4-5 and 11). Since Gratzel et al teaches the limitations of the instant claim, the reference is deemed to be anticipatory.

8. Claims 1, 3, and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Miyake et al (U.S. Patent 6,350,946).

Miyake et al teaches a dye-sensitized solar cell comprising a semiconductor electrode, a counter electrode; and an electrolyte between the semiconductor electrode and counter electrode, where the electrolyte can have the formula Y10-1 at col. 34, which reads on the instant 1,3-vinylalkylimidazolium iodide (see col. 3, lines 16-23; col. 3, line 63 through col. 4, line 3; col. 6, lines 32-38; col. 7, lines 9-18; col. 9, lines 28-65; and col. 37, lines 47-67; col. 41, lines 47-54; and Example 1 bridging cols. 45 and 46).

With respect to claims 3 and 4, Miyake et al's semiconductor electrode comprises a conductive transparent glass substrate, deposited titanium dioxide nanoparticles, and absorbed ruthenium complex dye (see col. 11, lines 5-20; col. 45, lines 29-33; and col. 45, line 64 through col. 46, line 13).

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Since Miyake et al teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gratzel et al (U.S. Patent 5,728,487) in view of Miyake et al (U.S. Patent 6,350,946).

With respect to claim 1, Gratzel et al teaches a dye sensitized solar cell comprising a semiconductor electrode; a counter electrode (i.e., instant confronting electrode); and an electrolyte between the semiconductor electrode and counter electrode, wherein the electrolyte can be 1-hexyl-3-vinylimidazolium iodide, which reads on the instant 1,3-vinylalkylimidazolium iodide (see the imidazolium chemical formula at the top of col. 3; col. 1, lines 4-13; and col. 4, lines 4-5 and 11).

With respect to claim 2, in Gratzel et al's Example 1 at col. 4, 1-hexyl-3-methylimidazole iodide is used at 75 parts by weight, while iodine is used at 25 parts by weight. In Example 2 at col. 5, a mixed electrolyte containing 1 part volume of 95 parts by weight 1-hexyl-3-methylimidazole iodide and 5 part by weight iodine, mixed with 2 parts in volume of a solution containing 30 mmol iodine is used.

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With respect to claims 3 and 4, the semiconductor electrode comprises a conductive substrate that can be transparent, absorbed Ru (ruthenium) complex dye, and a layer of nano-sized titanium oxide (see col. 1, lines 1-24; and col. 4, lines 63-67).

Gratzel teaches the limitations of the instant claims other than the differences which are discussed below.

With respect to claim 2, Gratzel et al does not specifically require that its electrolyte contains 1 to 30 mol% iodine based on the total weight of its 1-hexyl-3-vinylimidazolium iodide. Miyake et al teaches a dye sensitized solar cell having titanium oxide nanoparticles, dye, and electrolyte that comprises the combination of an iodide and iodine, where the electrolyte concentration is 0.1 to 15 M, and the preferred iodine concentration of 0.01 to 0.5 M (see col. 3, lines 16-23; col. 3, line 63 through col. 4, line 3; col. 6, lines 32-38; col. 9, lines 28-65; and col. 37, lines 47-67). Miyake et al's iodide can even be the instant 1,3-vinylalkylimidazolium iodide (see compound Y10-1 at col. 34). In Miyake et al's Example 1, there is used 0.02 grams (i.e.,  $7.874 \times 10^{-5}$  mole) of  $I_2$  and 0.7 grams (i.e.,  $2.632 \times 10^{-3}$  mole) of the iodide Y8-1. Thus, the mole percent of iodine with respect to the iodide Y8-1 is 3 mol%. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used, for example, 3 mol% of iodine with respect to Gratzel et al's iodide because such is a conventional concentration of iodine with respect to iodide, as shown by Miyake et al.

With respect to claims 3 and 4, Gratzel et al does not specifically teach that is transparent conductive substrate on which the titanium dioxide nanoparticles is deposited and dye absorbed, is transparent conductive glass. However, as seen in

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Miyake et al's Example 1, in particular, col. 45, line 64 through col. 46, line 13, it is conventional in the art to use transparent conductive glass for this purpose. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used transparent conductive glass for Gratzel et al's substrate onto which the titanium dioxide parties are deposited and dye absorbed because transparent conductive glass is conventional for this purpose, as shown by Miyake et al.

11. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyake et al (U.S. Patent 6,350,946).

Miyake et al teaches a dye-sensitized solar cell comprising a semiconductor electrode, a counter electrode; and an electrolyte between the semiconductor electrode and counter electrode, where the electrolyte can have the formula Y10-1 at col. 34, which reads on the instant 1,3-vinylalkylimidazolium iodide (see col. 3, lines 16-23; col. 3, line 63 through col. 4, line 3; col. 6, lines 32-38; col. 7, lines 9-18; col. 9, lines 28-65; and col. 37, lines 47-67; col. 41, lines 47-54; and Example 1 bridging cols. 45 and 46).

With respect to claims 3 and 4, Miyake et al's semiconductor electrode comprises a conductive transparent glass substrate, deposited titanium dioxide nanoparticles, and absorbed ruthenium complex dye (see col. 11, lines 5-20; col. 45, lines 29-33; and col. 45, line 64 through col. 46, line 13).

Miyake et al teaches the limitations of the instant claims other than the difference which is discussed below.

With respect to claim 2, Miyake et al teaches a solution of iodine and imidazolium iodide for its electrolyte (see col. 37, lines 47-67). Miyake et al teaches that the



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electrolyte concentration is 0.1 to 15 M, and the preferred iodine concentration of 0.01 to 0.5 M (see col. 3, lines 16-23; col. 3, line 63 through col. 4, line 3; col. 6, lines 32-38; col. 9, lines 28-65; and col. 37, lines 47-67). In Miyake et al's Example 1, there is used 0.02 grams (i.e.,  $7.874 \times 10^{-5}$  mole) of  $I_2$  and 0.7 grams (i.e.,  $2.632 \times 10^{-3}$  mole) of the iodide Y8-1. Thus, the mole percent of iodine with respect to the iodide Y8-1 is 3 mol%. Miyake et al does not specifically require that its electrolyte contains 1 to 30 mol% iodine based on the total weight of its iodide Y10-1. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used 3 mol% of iodine with respect to Miyake et al's iodide Y10-1 because Miyake et al shows that 3 mole % iodine can be used with respect to iodide.

### ***Conclusion***

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 6,756,537 and US 2005/0072462 are hereby made of record

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alan Diamond whose telephone number is 571-272-1338. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m. ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

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published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Alan Diamond  
Primary Examiner  
Art Unit 1753

Alan Diamond  
August 5, 2005

A handwritten signature in black ink, appearing to read 'Alan Diamond', with a stylized flourish at the end.